

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2015/2016

EOP4086 – OPTICAL SIGNAL PROCESSING
(OPE)

1st June 2016
2:30 P.M – 4:30 P.M
(2 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 3 pages with 4 Questions only.
2. Attempt **FOUR** out of **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1

- (a) Explain the basic concept of zone plate with a suitable diagram [6 marks]
- (b) A plane transmission grating produces an angular separation of 0.01 radian between two wavelengths observed at an angle of 30° . If the mean value of the wavelength is $5000 \text{ \AA}$ and the spectrum is observed in the second order, calculate the difference in the two wavelengths. [9 marks]
- (c) With the aid of a suitable diagram and equations, explain the theory of plane transmission grating. [10 marks]

Question 2

- (a) (i) What do you understand by coherence? [4 marks]
- (ii) With the aid of a suitable diagram explain the basic idea of temporal coherence of the light beam. [9 marks]
- (b) Calculate the coherence length of yellow light with $5893 \text{ \AA}$ in 10^{-12} second pulse duration. Find also the bandwidth. [5 marks]
- (c) Two light beams having intensities in the ratio 1:9 produce interference fringes with an observed visibility of 0.3. Calculate the visibility V of the fringes. What information can be extracted about the degree of coherence? [7 marks]

Continued...

Question 3

- (a) Explain with a suitable diagram how a lens works as a Fourier transform?

[9 marks]

- (b) Show that $\mathcal{F}\{f(x)\cos K_0x\} = \frac{[F(K-K_0) + F(K+K_0)]}{2}$ and that
 $\mathcal{F}\{f(x)\sin K_0x\} = \frac{[F(K-K_0) - F(K+K_0)]}{2i}$

[8 marks]

- (c) With the aid of suitable diagram and equations how do you transform a Gaussian function $\{f(x) = Ce^{-ax^2}\}$ in to a fourier transform?

[8 marks]

Question 4

- (a) During the construction of a hologram, a beam splitter is selected that makes the amplitude of the reference beam 10 times that of the signal beam at the emulsion. What is the maximum ratio of the beam irradiances there?

[7 marks]

- (b) Describe electrically written SLMs and Optically written SLMs.

[7 marks]

- (c) (i) Suppose that as a theoretical limit, 1 bit of information can be stored in each λ^3 of volume hologram at a wavelength of 400 nm and a refractive index of 1.20, determine the storage capacity of 2 mm^3 of volume hologram.

[6 marks]

- (ii) Describe the two types of holographic endoscope which is internal and external hologram recording endoscope.

[5 marks]

End of the paper